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Published in:
Antennas and Propagation Society International Symposium

Publication date:
1984

Document Version
Publisher's PDF, also known as Version of record

AN INTERCOMPARISON OF ANTENNA MEASUREMENTS MADE AT A SPHERICAL NEAR-FIELD RANGE, A CYLINDRICAL NEAR-FIELD RANGE AND A COMPACT RANGE.

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Introduction. It still can occur at presentations of far-field results from near-field antenna measurements that the question is raised how well they compare to real far-field measurements. Experience has shown that usually it is not possible to carry out far-field measurements sufficiently accurate to demonstrate the full accuracy of the near-field measurements. Instead one can measure for different values of the parameters in the near-field measurement configuration, e.g. the measurement distance, and observe how sensitive the far-field patterns are to such changes [1]. However, in order to obtain a more convincing comparison, the European Space Agency has arranged for measurements of a contoured beam antenna at three different near-field measurement systems in three different countries. The three measurement facilities are

1. The spherical near-field scanner at the Technical University of Denmark.
2. The cylindrical near-field scanner at MBB in Munich, Germany.
3. The compact range at Technical University, Eindhoven, The Netherlands.

The antenna was an off-set reflector antenna with a contoured beam produced by a linear array of four feed horns perpendicular to the off-set plane. Before the measurements were started, the feed support structure was enforced to prevent movement during the measurements. Also a mirror cube was attached to the antenna in order to define a coordinate system for the antenna and a reference direction for the definition of co- and cross- polarization in particular. An extensive series of measurements were carried out at the spherical range at TUD as described in a separate paper to this conference [1].

Comparison spherical-cylindrical. The comparison between far-field patterns from spherical [1] and cylindrical [2] measurements is shown in figure 1 for the two principal planes of the antenna. The cross-polar field has in both measurements been determined perpendicular to a side face on the mirror cube. Careful alignment of the near-field scanners, the probe polarization reference and the test antenna is essential for obtaining the indicated agreement.

Comparison spherical scanner - compact range. A similar comparison between the far-field patterns from the spherical near-field measurements and measurements carried out at a compact range consisting of two cylindrical reflectors [3,4] is shown in figure 2. Note that the angular scale has been changed relative to figure 1. Also the cross-polar patterns are changed relative to figure 1 because the polarization of the feed horn in the compact range was aligned

CH2043-8/84/0000-0686$01.00

to produce a null close to $\theta = 0^{\circ}$ rather than perpendicular to a cube face. Since both amplitude and phase of the two field components are known from the spherical near-field measurements it is possible to rotate the polarization reference in the computer and by rotating 3.83°, the agreement in figure 2a is obtained. The same reference angle is used for the spherical measurements in the $\phi = 90^{\circ}$ cut, while the feed horn in the compact range has been aligned separately for this cut. The fact that the cross-polar values are not the same for $\theta = 0^{\circ}$ indicates some misalignment of the compact range. Table 1 gives some specific numbers for the comparison.

	TUD	MBB	THE
lobe $(\theta,\phi) = (5.1^{\circ},0^{\circ})$	- 0.19	- 0.19	- 0.13
side lobe $(\theta,\phi) = (7.6^{\circ},90^{\circ})$	-20.2	-20.6	-22.2
cross-polar max $\phi = 0^{\circ}$ plane	-20.8 -17.0	-21.5 -	- -17.2

Table 1. Comparison of specific values in dB relative to co-polar max.

References

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This work was carried out under work package WP2 of a rider to ESA Contract 4682/81/NL/NS(SC).

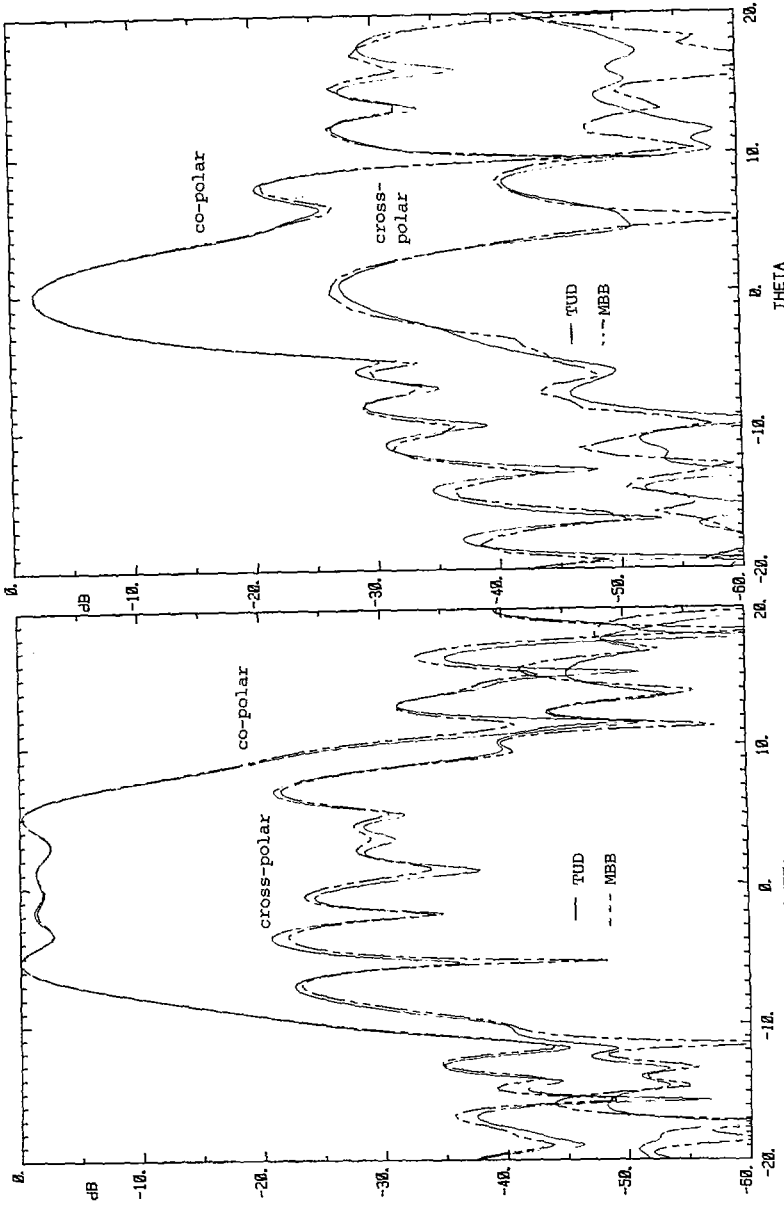

Figure 1a: Far fields in the $\phi = 0^{o}$ plane.

Figure 1b: Far fields in the $\phi = 90^{o}$ plane.

Comparison of far fields obtained from spherical and cylindrical near field measurements.

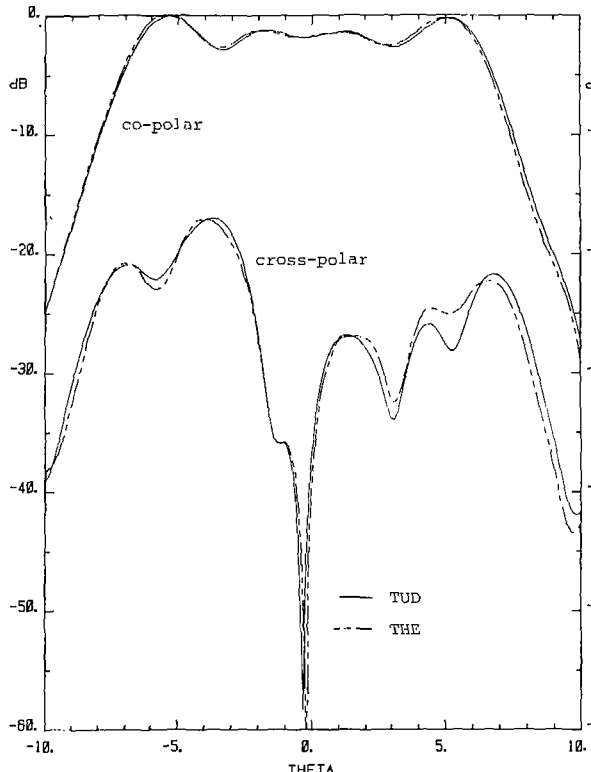

Figure 2a: Far fields in the $\phi = 0^{o}$ plane.

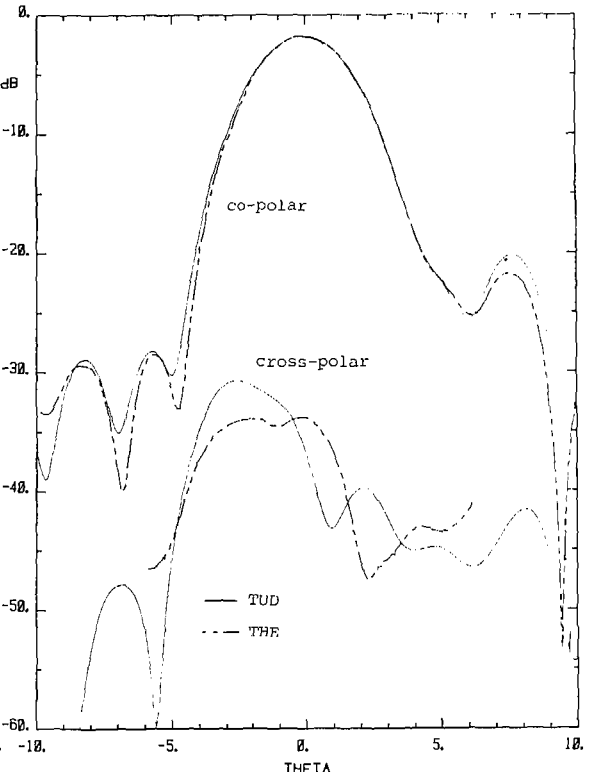

Figure 2b: Far fields in the $\phi = 90^{o}$ plane.

Comparison of far fields obtained on a spherical near field range and a compage range.